POSTHARVEST INSTITUTE FOR PERISHABLES

NIS Potato Storage Project

in

Russia and Ukraine

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University of Idaho
College of Agriculture

Postharvest Institute for Perishables

Technical Assistance and Training Project to Reduce Storage Losses of Potato and Facilitate Future Business Opportunities

RUSSIA and UKRAINE

Trip Report:

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Summary

Russia has a well-educated population and vast natural resources, and scientists have a strong knowledge base in many but not all areas needed for agricultural development. Climate limits plant varieties that can be grown and the yield potential for most crops. Poor transportation facilities often limit both the quantity and quality of goods that can be delivered to population centers. The country as a whole does not have an effective extension delivery system to make agricultural information available to those who need it. (See Appendix I for schedule in Russia).

The Postharvest Institute projects can assist most by developing training programs in specific areas and by encouraging an appropriate extension system. Specific recommendations are given below:

Recommendations

1. Evaluate Russian Potato Concern program plans. Dr. Moiseev, Head of RPC, has provided a detailed summary of RPC's long-term program plans (Appendix V). He would like our assessment of this. Are their plans up-to-date? Do they have appropriate innovations? Do we have suggestions?

2. Establish USAID-sponsored storage facilities as models to promote efficient private farming operations. The two farms of Dr. Juri Krasnov and Dr. Stepan Ginin are excellent sites for USAID-sponsored storages to demonstrate two innovative approaches to private farming. Krasnov represents the "American pioneer homesteading" approach. He is truly

private, has the involvement of five to eight families, and brings tremendous talent and initiative to farm development. There is always risk with any new business, but farms such as this must succeed if private enterprise is to become established in Russia.

Ginin represents the conversion of a large, state-directed collective into a private business. The privatization process is undoubtedly not yet complete, but this operation is so large and so productive that it can provide strong leadership nationwide for the success of privatization. An example such as this must succeed if others are to follow, and this operation has the potential to become a very efficient farm operation. Larger cooperative operations could benefit immensely from more modern and sophisticated storage units, such as the USAID-sponsored units produced by Global Steel. In both instances, the USAID supported storage facilities can serve as a model and can be used effectively in training programs.

3. Translate and promote anti-bruise videos. The anti-bruise videos were well-received and should be translated into Russian and Ukrainian for use by research scientists and for training programs by agricultural specialists. Care must be taken that the specialized terms are more fully described, e.g., "primary" means "primary chain," "secondary" means "secondary chain," etc.

4. Provide information by subscribing to relevant trade magazines. Scientists at RPC and the Institute for Potato Research in Ukraine were given samples of three trade magazines that are used extensively in the U.S. by scientists, farmers and specialists. In both instances they were excited by the prospect that PIP could send them copies on a regular basis. They face a dearth of information, and these publications include articles by university specialists,

private consultants, feature articles on successful farm operations in the U.S., plus numerous advertisements for agricultural equipment and chemicals. They were intrigued as much with the ads as the articles. These three publications are: Potato Grower of Idaho, 520 Park Avenue, Idaho Falls, ID 83402 ($19 per year in US); Potato Country, P.O. Box 1467, Yakima, WA 98907-1467 ($15 per year in US, $45 per year foreign); Spudman, P.O. Box 1752, Monterey, CA 93942 ($1 per year U.S., $26 per year foreign).

5. Develop short-term and long-term training programs. Training programs, both short and long-term, are needed in several critical disciplines (see below). It is important that specialists, managers and farmers in Russia and Ukraine have an opportunity to see U.S. operations first hand, and that specialists from the U.S. be sent to those countries. For long-term development, Russian and Ukrainian students should be sponsored for graduate programs (M.S. and Ph.D.) at U.S. institutions.

Short-term Training

A. Bruise reduction. Training programs should be established in Russia and Ukraine regarding principles and methods of bruise reduction. Larger farm operations need extensive equipment modification to achieve management objectives. U.S. agricultural engineers should be sent to Russia to modify existing equipment as examples of appropriate design.

B. Seed certification. Russia currently has a potato seed certification program, but both research scientists and farmers have admitted that it is not working effectively. They are not testing all diseases that should be monitored. Testing methods and frequency of testing are inadequate, especially with later seed generations. Specialists from seed certification

programs in the U.S. should be sent to help establish a more effective program. Some assistance may be required with equipment and supplies, but the greatest need is for an infrastructure that more widely applies existing seed health technology to all seed generations.

C. Economics and marketing. Scientists, specialists and farmers in Russia are only beginning to grasp the complexities of cost accounting, economics and marketing. Specialists in Russia should receive short-term training in the U.S. (perhaps a one-semester program) and U.S. specialists should be sent to Russia in marketing and basic cost accounting.

D. Storage design and management. Very small operations (the equivalent of home gardeners) have very effective storage in the ground and/or cover over with straw. Their losses are minimal, and it would be pointless at this time to attempt changes in these proven methods. Medium-sized farms could use storages constructed of poles, straw and earth like those that were used extensively in Idaho during the 1940s and '50s. They are inexpensive, can be constructed with local materials, and are relatively effective. PIP could sponsor the construction of model units in Russia and Ukraine, and such units should be fitted with appropriate ventilation systems and humidity controls.

The PIP proposed project to bring base storage managers from Russia to Idaho for agribusiness training should be duplicated also in Ukraine.

E. Potato processing. Currently only three percent of the Russian potato crop is processed (primarily for starch). Virtually all those we met in Russia agree that a more extensive processing industry is needed. PIP should sponsor specialists from the processing industry, in conjunction with economists, to offer advice and training in this area.

Areas for Additional Cooperation

A. Extension delivery system. A more effective extension delivery system is sorely needed. We have been advised that other institutions within the U.S. are developing proposals for federal funding to address this need. As a result, PIP may wish to concentrate its programs in other areas.

B. Exchange of plant breeding materials. Breeding programs in both Russia and Ukraine requested an exchange of varieties and potato germplasm from the U.S. The USDA/ARS potato breeding program at Aberdeen, Idaho, has been doing this extensively with other countries, and it will be a simple matter to extend this exchange to Russia and Ukraine.

C. Cooperative research programs. Efforts in this category will be slower to develop and will require a longer time frame for results. If funding can be obtained, areas of emphasis for cooperative research include: storage management for specific varieties and conditions; production forecasting relative to environmental and pest variables; biological and cultural controls as alternatives to pesticides and ecological problems resulting from contaminants such as heavy metals and radioactive materials. This last item will require a substantial long-term input but is critically essential to the future of agriculture in the former Soviet Union.

Site Visits

McDonald's of Europe (Frankfurt, Germany)

McDonald's restaurant in Moscow currently handles 12-13,000 transactions per day, and they intend to open two additional restaurants in Moscow during this summer. They presently contract for production of 120 ha of Russet Burbank and are buying potatoes from local farmers of several Dutch varieties, including Agria, Fambo, Fresca and Friesia. Agria

is a new variety that is described as "environmentally friendly." It requires relatively little chemical input because it purportedly has good resistance to nematodes and late blight (foliage has resistance but not tubers). Agria has a long dormancy period, although not as long as that for Russet Burbank. In terms of storage programs, the greatest needs are for better handling equipment and better management training.

Russian Potato Concern (RPC) or Concern Roskar

This organization has been discussed in detail in previous reports. Headed by Dr. Yuri Moiseev, the RPC is an affiliation of research institutes and farms, both state and private. It has a board of directors and four divisions: 1) management/administration, 2) science, 3) production, and 4) business/marketing. Funding is derived from three sources: government (often under contract), international projects (such as USAID), and private enterprise. Moiseev alluded to the possibility that RPC might privatize into a stock-share company that would work under contract with private and state agencies.

The principle objectives of RPC are: 1) Seed potato production, 2) establishment of seed certification centers for "elite" and subsequent seed generations, 3) new cultivars for starch, processing and other uses, 4) development of biological control agents for pests, 5) increase in commercial production for export, 6) storage construction and technology, 7) development of machinery and technology for harvest, sorting, etc., and 8) education.

The three main concerns of RPC, according to Moiseev, are:

1) Certified seed -- Russia has a system in place, but it's not complete or effective at this time. This is a prime area for cooperative development and assistance from PIP.

2) Storage -- Needed at larger production sites and urban distribution centers. Large-scale storages are poorly designed and poorly managed. About 70 percent of the crop is stored and of that at least 20 percent is lost.

3) Potato processing -- for both domestic and international sales.

Dr. Moiseev has proposed the following areas for cooperative research projects. 1) Storage -- need to verify best temperature and ventilation conditions for specific varieties and conditions, old vs. new, diseased vs. disease-free. 2) Production forecasting, to anticipate storage and marketing needs. 3) Ecological problems -- contaminants, such as heavy metals and radioactive materials, are reducing yields and storageability of potatoes.

Other areas for cooperation include visits, both long-term and short-term, of U.S. specialists to Russia and also Russian specialists to the U.S. Sponsoring Russian students for graduate programs at the U. of I. has particular merit for development of long-term relationships.

According to RPC estimates, 91 percent of the Russian potato crop is consumed directly by the producer, and only nine percent is marketed domestically. This past year, Russian officials imported 400,000 tons of potatoes from Poland. (Others have speculated that this is an attempt by hard-liners to flood the market with low cost, subsidized potatoes, thus hampering private enterprise).

By most estimates, at least two-thirds of the crop is produced in very small operations similar to home gardens. These potatoes from small operations are dug by hand and are stored in the ground under straw or in small cellar type facilities. Because of the care these potatoes receive with hand harvesting and due to the effectiveness of their simple storage facilities, losses are very low. Larger operations, on the other hand, which account for one-third of potato production, use mechanical harvesters and inflict severe mechanical

damage. According to RPC estimates, Russia produces 250 kg of potatoes per person. Of the 250 kg, only 100 kg are eaten, 60 kg are used for seed (very poor quality), and 90 kg are lost. Only three percent of the crop is processed (for starch or spirits). Russia now imports 55 percent of their vodka and they now make vodka from wheat, not potatoes. Dr. Moiseev claims that RPC members are responsible for one-third of total potato production in Russia, produced by former state owned farms.

Potatoes harvested on larger farms often have 20 to 50 percent damage going into storage. There is tremendous need for a bruise reduction program, including modification of equipment and educational programs. The bruise prevention videos taken to Russia and Ukraine should be translated into Russian for educational programs.

RPC has developed a plan to distribute seed potatoes to small farmers. They will store seed in the two USAID-sponsored storage buildings. RPC will provide farms with seed, technical recommendations and will help with marketing. Moiseev has proposed three types of contracts for those who wish to store their seed in the USAID-sponsored storages: 1) RPC would buy all seed outright from the farmer, 2) farmers would rent storage space at a cost of 10 percent of market price of potatoes for that year, or 3) RPC would buy half the seed and the farmer would rent storage for the other half. Moiseev would also be willing to accept 10 percent of the crop as payment for storage.

RPC would like technical and financial support from PIP to develop the initial seed potato program. RPC is looking for seed growers who have combined private ownership with appropriate technology and innovation. RPC would also like to export seed to Uzbekistan as a source of revenue. Uzbekistan purportedly paid US $15.5 million this year to import 30,000 tons of seed potatoes from Holland.

RPC would like to develop a larger processing industry, which presently accounts for only three percent of the potato crop. They hope to expand starch production, perhaps develop a chipping industry, and expand into frozen products. RPC is negotiating a contract with a British company to open two large kitchens and 15 restaurants in the Moscow area, which will feature stuffed baked potatoes. RPC farms will grow the Majestic variety (from Scotland) under contract for this purpose. Currently at least 95 regional potato varieties are grown in Russia.

Private Farm of Yuri Krasnov, Zalugi, Stupinski District, Moscow Region

Yuri Krasnov is leader for a group of five families, soon to expand to eight, who have obtained legal ownership of 458 ha of farm land that was formerly part of a military-space complex. They currently have 108 ha under cultivation and are leasing 350 ha to a collective farm until they're ready to expand operations. This is their third year of operation, and they have bartered earlier crops and produce for trucks, planters, harvesters and earth moving equipment. They have constructed buildings for cows and swine, have a fish pond with sturgeon for meat and caviar, and produced 10 tons of honey this past year. Krasnov, who has Ph.D. degrees in physics and philosophy, has actively sought information from agricultural specialists.

Krasnov would like to produce elite potato seed on his most recent appropriated land, which has not been in agricultural production since 1956. It is not easy to buy good seed in Russia. Krasnov presently buys super elite in the spring, but with no place to store the crop he must market or barter it in the fall. For this reason, Krasnov has affiliated with RPC and has been identified as a site for one of the USAID-sponsored storage units. He

intends to produce 2,000 tons per year of elite seed and will also store seed for neighbors. His potato yields have ranged from 12 - 35 tons per hectare and average 30 t/ha.

Institute of Space Device Engineering

This unit has been converted from military operations and is currently seeking cooperative ventures to generate operating revenue. Dr. Ponomarev, the director of 10 agricultural projects, is interested in hydroponic minituber production for elite potato seed. They have completed small scale trials (producing 1000 tubers from one square meter in three months) and hope to produce three to five million minitubers per year to supply the larger commercial and collective farms. They also hope to develop a potato processing plant. They apparently have competition since we learned of at least two other minituber production facilities near Moscow.

Institute of Phytopathology, Bolshie Vjazemy, Moscow Region

This operation could more appropriately be termed the "Institute for Plant Protection," since it encompasses molecular biology, entomology, physiology, herbicides, toxicology, biological control, and pesticide synthesis, as well as traditional areas of phytopathology. This Institute is not a direct member of RPC but has close cooperative ties with it. They have 620 people at the central institute, including about 100 doctoral scientists. The Institute has 120 ha of land and nine greenhouses plus an additional 2,000 ha in central Russia, 400 of which are used for research and the balance farmed for income.

The Institute works in three main areas. Thirty percent of their people and resources are devoted to selection for disease resistance and studies of pathogen virulence. They test 150 potato varieties each year and would like to include some American varieties.

They have tried many varieties from Holland, but they have not been suited to the Russian climate. Twenty percent of their effort goes into biological and cultural control. Fifty percent of resources are used for chemical control, including pesticide synthesis, control strategies, screening and toxicology of pesticides, resistance to pesticides, and recommendations for farmers.

Principle disease problems of potatoes in Russia are: 1) Fungal -- late blight (most serious disease throughout the country), early blight (in drier eastern regions), Rhizoctonia (in cold soils); 2) Bacterial -- blackleg, ringrot, and Pseudomonas brown rot; 3) Viral -- PVX, PVY, leaf roll (identified as "L" in Russia and Ukraine). Late blight is the major disease problem in Russia accounting for 5 - 13 percent losses nationwide. Scientists are working to determine best timing of treatment in connection with weather conditions. All fields on large farms are sprayed at least once (usually with Ridomil) for late blight. The most severe late blight occurs in western Russia where rainfall is greatest. Seed fields receive up to five chemical sprays to control diseases. They begin with polycarboxin and Ridomil and finish with contact sprays (usually copper-based). A national committee (FRAC, Fungicide Resistance Action Committee) attempts to manage fungicide applications to limit development of resistance to the fungicides by pathogen populations.

Agricultural specialists in general spend at least 90 percent of their efforts on research and no more than 10 percent on extension. Specialists summarize research results in small booklets which are distributed to the plant protection centers in each rayon (similar to our counties). We were told that each plant protection center has as many as 100 to 150 employees. Unfortunately, they are relatively ineffective in getting information to the farmers. Some specialists from larger farms will actively seek information from the plant protection centers, but the centers apparently take little initiative to develop extension

programming. Other sources advised us that half the employees at these centers do no work at all and the others simply perform administrative functions.

Privatized Joint Stock Agicultural Company, Vladimir Region

Under the direction of Dr. Stepan P. Ginin, an agricultural economist, who has been Director since 1956, this former collective farm is an excellent candidate for the second USAID-sponsored potato storage. This farm supports a village of 1200 people, including 900 workers (share owners) and 300 school children. Stock shares were divided according to years of service and contribution to the farm. The state still attempts to set quotas for distribution of products, but the farm is sufficiently large and diverse that it is able to market a sizable amount to the highest bidder.

The farm has five divisions with a director for each division: plant production; cattle; technical (equipment); buildings (construction and maintenance); and marketing. The central office has five computers, one for each division. This private enterprise encompasses 14,000 ha, with 6,000 ha in active use and 3,000 ha in cultivation, including 1,600 ha under irrigation and considerable forest land. They produce 400 ha of potatoes, plus corn, wheat and hay. Cattle operations include 1000 milk cows. They also produce fish and honey for local consumption The farm has a hard currency account with a current balance of US $390,000. They have hosted guests from Italy, Germany, Turkey, Israel and the U.S. in recent months.

Potato yields average 32.7 t/ha, compared to the Russian average of 10 to 15 t/ha. They use some chemical pesticides but try to minimize them for environmental reasons. The farm has its own agronomy specialists who seek information from plant protection centers and other farms. Pesticide applications for late blight are based upon weather

forecasts and recommendations. They buy elite seed every three years and recrop their own seed on alternate years. They often must buy their seed from other regions or republics to obtain the quality they want. They have a potato storage building constructed in 1970, used primarily for seed storage, which has ventilation but no temperature or humidity control. Seed in storage on the date of our visit (May 7) was in good condition. Seed tubers were relatively firm and had only begun to sprout. Planting of this seed was scheduled for the following week.

Equipment is mechanized for large-scale operations, but much of it was manufactured in the former Eastern Germany and is of poor quality and design. As a result, bruising at harvest (in the field and during sorting) typically runs 20 percent and sometimes as high as 50 percent They would like to develop a potato processing plant.

Institute of Biophysics & Biochemistry

These scientists are undertaking a task that could easily consume 100 scientists, examining pesticide residues and environmental contaminants relative to potato production and consumption. They are currently assaying for hexachlorobenzene and other chlorinated hydrocarbons (such as DDT), Lindane, Sencor, and others. They are also testing potential benefits of ozone applied to potatoes in storage to improve pest control.

Pesticide analyses began only two years ago. They have some modern equipment (HPLC, GLC, IR and mass spectometry). However, because of hard currency restrictions, they are desperately short of critical reagents, reference books, and appropriate computer software programs that are needed to operate equipment already in place. (See Appendix IV for specific needs for this laboratory).

Institute of Molecular Genetics

This Institute is not directly connected with RPC, but scientists here have cooperative research projects with the Institute for Potato Research, which is located near Moscow. They are cooperating with the potato breeding program and working on genetic transformation of potato varieties. One objective is late blight resistance, although they have not yet succeeded in this effort. The Institute for Potato Research, which was not visited on this trip, is part of RPC. According to other RPC scientists, this latter institute has good programs in variety development, mechanical engineering, and potato production, but their other programs, including storage management do not appear to be top quality.

UKRAINE

Summary

Ukraine is rich in resources (fertile soil, water, science, agricultural and industrial technology, labor) though somewhat deficient in petroleum energy. In this sense, Ukraine is not a typical developing country. Rather, it has a developing country economic infrastructure. It is attempting to refocus its resources on domestic issues such as privatization, business development, and marketing. Agriculture specifically related to production efficiency, produce quantity and quality, storage, distribution, and domestic and international marketing, is one of the largest sectors of the economy. Enterprises hold some of the best opportunities for science and technology applications and for business, economic, and market development.

Private farms, small scale markets, cooperatives, stock shares, and joint venture businesses are in various stages of transition and development. The need is not to encourage such enterprises, which will continue to rapidly emerge, but to provide guidance for fair markets, regulated competition, marketing principles, joint ventures, and principles of privatization wherein everyone is afforded a chance to participate and benefit. In Ukraine, for example, approximately 75 percent of all potato production already occurs on private farms. Of this private production, approximately 75 percent occurs on small plots (less than five ha) and on small farms and in home gardens. Current governmental infrastructure is geared to support large state/collective farms. The challenge is to bring state support also to the new private and small farms and put them in a profitable market setting. (See Appendix I for Itinerary in Ukraine).

Recommendations

1. Agribusiness -- The greatest mutual benefit for the US and the Ukraine lies within linkages that lead to joint business ventures. This would assist emerging Ukraine businesses while expanding U.S. companies' opportunities. A further benefit would be a strengthened US-Ukraine long term alliance. Relative to potatoes, there appears to be considerable opportunity for US agribusinesses to participate in joint ventures that focus on production, harvest, handling, storage, processing, wholesaling, and marketing. Potato processing businesses may hold the most promise and the most immediate opportunity to meet the expressed needs of Ukrainian producers and consumers. Beyond this, the certification and sale of healthy seed stocks, construction of production-site storages, improvement of distribution-site storages, and refitting harvest and handling equipment to reduce mechanical injury would have significant benefit.

2. Marketing -- Training in basic marketing principles should be provided at the UI or within Ukraine regions and districts, especially for new private farmers but also for personnel in emerging middle industries such as transportation, storage, packaging, and wholesaling. Initial workshops or training packages would benefit managers of newly privatized (multiple owner) joint stock farms.

3. Potato Bruise Reduction -- Make wide use of UI video tapes on potato bruising. Add Ukraine voice-over to these videos and make multiple copies for distribution through Ukraine Institute for Potato Research (UIPR) to farm managers, crop specialists, and district agricultural specialists. Send teams of UI extension potato specialists to offer expert

commentary on the tapes during training sessions. Send teams of agricultural engineers/machinists to offer instruction on harvester modification and operation to reduce bruising and improve separation of soil and debris from harvested potatoes. Training teams could also demonstrate exemplary modification of one harvester on each of several selected farms.

4. Seed Certification -- A procedure for annual field/lab inspection of seed stocks and fields is needed to maintain and certify seed quality beyond the elite (first) generation. Current technology for seed health testing in Ukraine appears appropriate but limited in application only to early generation seed. Plant protection specialists within the Ukraine and the UI should be brought together. Ukraine specialists, for example, should witness a functioning seed health testing program such as provided jointly within Idaho by the State Department of Agriculture, Crop Improvement Association, and the College of Agriculture.

5. Storage -- Potato storage managers, transporters, and handlers should have training in principles of good storage structure design and maintenance; environmental control systems for regulating temperature, ventilation, and humidity; economics of storage construction, purchase and rental; and pest control. This can occur on-site at the UIPR utilizing the new USAID/Global Steel storage facility or at UI sites such as at Kimberly, ID. The new potato storage facility at the UIPR should be a valuable resource for training, demonstration, and eduction as well as for research on potato storage and seed quality.

6. Graduate Training -- Applications of Ukraine professionals working in production, economics, storage, pest control, marketing, extension education, etc., should be encouraged for graduate study leading to MS or PhD degrees.

7. Extension -- Educational programs such as those delivered through cooperative extension in the U.S. are needed. Information and technology from Ukrainian academies and institutes is exchanged between scientists and with plant protection specialists in the districts. These specialists, working more like county agents in cooperation with the emerging Ukraine Farmers Organization, could provide the infrastructure to deliver needed information to the growing community of private farmers.

8. Cooperative Research -- Areas of mutual research interest for Ukraine and UI scientists include germplasm exchange and variety development, cultural and biological pest control as alternatives to pesticides, market analysis and forecasting, nutrition and toxicology, and machinery modification and design.

Ukraine Institute for Potato Research (UIPR)

We delivered UI potato bruise videos, potato production and trade magazines, and a scientific supply catalog to Director Anatoly Kuchko. These items were well received. A list of scientific equipment will be prepared and faxed to PIP.

The UIPR appears to be a stable state supported unit. It has some recognition throughout the country especially for variety development, seed health certification and production technology. It focuses on three principle potato production environments in Ukraine: Polasi north of Kiev, Mid forest and desert; and South irrigated zone. In this

latter southern region of the Ukraine, it is possible to double crop (grow two crops of potatoes per year).

The products generated by UIPR (data, production recommendations, varieties, seed, etc.) are distributed to additional specialists in regional and district offices. In turn, the new information and technology is sent to users especially on state/collective farms. There appears to be no similar infrastructure other than newspapers, radio, and TV for such information and technology to reach the growing number of small private farmers/gardeners. This district infrastructure in Ukraine resembles that of county extension programs in the US but it does not appear to be as effective in reaching clientele. The educational needs of new private farmers, for example, are largely left unaddressed.

The UIPR is dispersed among 22 experimental sites in the Ukraine. The main center near Kiev has approximately 55 scientists and 220 employees. It also employs another 250 people at outlying stations. The UIPR is financed by the national government and the Academy of Agricultural Sciences. Its annual operating budget (which has been devastated by inflation) currently stands at 70 million coupons. Trips were somewhat restricted because fuel was in short supply. The UIPR would like to expand its research to include potato processing and storage.

Potato production occurs on 1,200,000 private and 400,000 state hectares in Ukraine. The UIPR supply seed (elite and early generations) only to state farms. A Ukraine Elite Potato Association is being developed under the Ministry of Agriculture to address the need for wider seed distribution and improving standards of seed quality. It is to have a governing board, private and public members, and be financed by membership fees, seed sales, and bank loans.

The PIP/UI training effort in Ukraine could provide the most immediate benefit by focusing on marketing strategies (micro, macro, forecasting, structure), seed certification especially for later generations, bruise reduction, and storage improvements (currently losses in storage are estimated at 30 percent). The UI potato bruise videos, for example, with Ukraine voice-over could be distributed to district specialists by the UIPR. UIPR scientists also expressed an interest in developing processing expertise which is currently unavailable. Storage facilities especially for seed (via Global Steel) also appeared to be a high priority on larger farms (production sites) and in urban areas (distribution sites).

Potato yields average 20 tons/ha for the mid region of Ukraine and range from 10 to 50 tons/ha. New private farms can receive 50-70 million coupons from the state for start up (currently 3000 coupons per U.S. $1). However, they must show production progress over three years to receive additional subsidy. Currently Ukraine produces 300-400 kg of potatoes per person. Of this amount 120 kg is consumed and the balance is utilized for animal feed, starch and alcohol production, or is lost in the postharvest process.

Managers of State Farms

We met with approximately 20 managers of potato production on state farms in the Borodyanka District near Kiev with a population of 65,000. In this District, potatoes account for 2500 ha and 3000 ha on state and private farms, respectively. Of the total potato production in the district, 70 percent is for consumption and 30 percent is for seed. Seeding rates are three to four tons/ha.

The biggest production problem on small farms/gardens in the District is potato cyst nematode (Globodera (Heterodera) spp., probably rostochiensis). Small farms and gardens do not have sufficient option to rotate to non-host crops to avoid infection. On all farms,

the Colorado potato beetle was cited as a major perennial problem followed in most seasons by late blight (Phytophthora infestans). There was little concern about on-farm storage except in small amounts for consumption or for seed which can be satisfactorily accomplished in ventilated straw-covered earth shelters. Most of each harvested crop is sold and delivered to the state and its storage/distribution centers. The state price currently is 60 coupons/kg vs. 100 coupons/kg in private markets. Mechanical losses were ascribed only to machine harvesting on large farms and estimated at 10 percent. The District (like Kiev) is in Chernobyl Radiation Zone Four where residents receive 20 percent more salary and are exempt from taxes. Some also receive early retirement options and housing at reduced cost.

Poleskaya Breeding Station, Peredrizhne

This breeding station is an affiliate of the UIPR. It focuses mainly on potato breeding, husbandry, seed production, and chemical protection against pests. It has 20 scientists (six with advanced degrees), 30 assistants and 200 field workers on 1,100 ha. Its breeding priorities include early maturity (to permit double cropping), and resistance to potato cyst nematode, bruising, wart (Synchytrium), and late blight. The station developed 10 new varieties over the past 20 years which currently account for about 10 percent of all potato production in Ukraine. Most of the current varieties grown in Ukraine come from Belarus and Russia. "Poleski Rosavui", for example, is the oldest and most popular variety in Ukraine. The Breeding Station provides early generation seed only to larger (greater than 20 ha) state farms.

Consumers prefer potatoes with pink skin and white flesh. The cultivars "Zov" and "Dobrichin" developed at the Poleskaya Station have good quality and resistance to most

pests. There was not much concern about storage losses on the station where potatoes were stored successfully on the ground under straw. A new interest of the potato breeder was to develop potatoes for processing such as for chips. He specifically requested an assortment of potato germplasm from the U.S. for testing and to use in his breeding program. (This exchange can take place with old, nonpatented varieties.)

Ukraine Farmers Organization

This new organization is formulating its leadership and membership. When established, it should be a good vehicle for reaching small and private farmers in Ukraine. It has a potential membership of more than 50,000 farmers. It has access to TV and radio and to newspaper communications. It can utilize segments of a 30-minute daily agricultural radio program. It can have articles printed within the weekly farm paper from Kiev with a circulation of less than 10,000. It can enlist air time on "Chas", a weekly one hour television farm program from Kiev that reaches 10,000-20,000 farmers across Ukraine. Leaders also have partial responsibility for the Ukraine Exhibition held in Kiev in November of each year. The Exhibition features demonstrations, new farm products, and techniques.

The organization reported that of some 600 attempted joint ventures to date in the Ukraine, only 20 percent have been successful and account for only 0.5 percent of the national product.

Base Storages

We visited two of 15 base storages that serve Kiev. Stored and shipped produce included potatoes, onions, red beets and carrots. One of these large storages, in the Leningrad district outside Kiev, was visited and described earlier in 1993 by Bob McGee.

The second, however, was only one km from the first, less than three years old, and built with assistance from Finland. It was modern with multiple large compartments and with computerized temperature, ventilation and humidity control. There were no data to compare the losses in this modern facility with those in adjacent more conventional storage buildings. The manager claimed this was the only base storage in Ukraine with humidity control. His computer readout showed 90-95 relative humidity in potato storage rooms.

It was interesting to note that the volume of produce at this second base storage was now 20,000 tons compared to 60,000 tons a few years earlier. In fact, in 1989 an additional storage building was being constructed to accommodate additional produce. Today, such construction has stopped and most storage rooms are empty, apparently because the developing private sector has found routes to move its produce to markets apart from selling and shipping to state base storages. We were told that the state cost to transport beets, for example, to this storage was 50 coupons/kg whereas the price for beets in the state market was 30 coupons/kg. The manager was able to rent storage space (to private farmers). However, no space was rented because rental costs were high.

USAID Ukraine

Jim Osborne related that all training proposals should go to Tom Chapman at USAID in Washington DC (FAX 202-647-4756, phone 202-647-5675). USAID is awaiting the advice of a training consultant team regarding the distribution of training funds. Currently there is no interest in funding agricultural research projects. USAID is emphasizing joint ventures with American businesses and agribusinesses in Ukraine. The Citizens Network for Foreign Affairs Program (under the direction of Jim Archer) is being put in place to encourage joint ventures. This program is funded by USAID. The earlier

farmer-to-farmer programs are essentially over. Until training guidelines are in place, USAID is able to accept and fund unsolicited training proposals.

APPENDIX I

ITINERARY

RUSSIA

Sun. May 2	--	Arrive Moscow, 3 pm
Mon. May 3	--	Russian Potato Concern (RPC)
Tue. May 4	--	Private Farm of Yuri Krasnov, Zalugi, Moscow region
Wed. May 5	--	Institute of Space Device Engineering, Moscow
Thur. May 6	--	Institute of Phytopathology, Moscow
Fri. May 7	--	Privatized (former collective) farm, Vladimir region (overnight)
Sat. May 8	--	Continuation at privatized farm, return to Moscow
Sun. May 9	--	Holiday
Mon. May 10	--	Institute of Chemical Physics, Moscow
		Institute of Molecular Genetics, Moscow
		Leave for Kiev, 9 pm via night train
Wed. May 19	--	Return from Kiev by train, arrive Moscow, 9 am
		Russian Potato Concern, Moscow
Thur. May 20	--	Depart Moscow, 10 am, return to Idaho

ITINERARY

UKRAINE

Tue, May 11	--	Arrive Kiev, 9:30 am via night train from Moscow
Wed, May 12	--	Ukraine Institute for Potato Research
Thu, May 13	--	Crop Managers of State Farms
Fri, May 14	--	Poleskaya Breeding Station, UIPR
Sat, May 15	--	Ukraine Farmers Association
Sun, May 16	--	Holiday
Mon, May 17	--	Kiev Base Storages, Leningrad Dist.
Tue, May 18	--	USAID, Kiev
		Return via 7:00 pm night train to Moscow

APPENDIX II

LIST OF RUSSIA CONTACTS

McDonald's of Europe (Frankfurt, Germany)

Del Thornley

Frank Cassias

RPC

Dr. Yuri Moiseev, Head of RPC

Nadya Rodina, Assist. to Head, Marketing

Dr. Ludmilla Eliseeva, Head of Storage Dept.

Dr. Elena Barinova, Specialist on Pesticides & Environmental Contamination

Dr. A.V. Filippov, Institute of Phytopathology

Private Farm of Yuri Krasnov, Zalugi, Stupinski District, Moscow Region (Tel 398-2979, home; 521-9733, office)

Institute of Space Device Engineering

Jury N. Korolev, President

Dr. Ponomarev, Director for Agricultural Projects

Institute of Phytopathology, Bolshie Vjazemy, Moscow Region

Dr. Anatoly Makarov, Director

Dr. S.S. Sanin, Head of Cereal Disease Laboratory

Dr. A.V. Filippov, Head of Potato Disease Dept.

Dr. V.P. Dubovoi, Marketing Director

Dr. Vitali Djawakhia, Head of Molecular Biology Laboratory

Privatized Joint Stock, Vladimir Region

Gud-Khrustal District, Ulyakhine (Tel 2-35-43 or 2-67-87)

Dr. Stepan P. Ginin, President

Dr. Gennadiy Chanov, Head of Production, Storage & Processing for RPC

Dr. Ludmilla Eliseeva, Head of Storage Dept. for RPC

Institute of Biophysics & Biochemistry

Dr. Klara Gumargalieva, Head of Lab.

Dr. Elena Barinova, Specialist in Pesticides & Environmental Contaminants

Institute of Molecular Genetics

Dr. Eleonora Piruzian, Head of Dept.

APPENDIX III

LIST OF UKRAINE CONTACTS

Ukraine Institute for Potato Research

Igor Kholodylo, Assistant to Director

Anatolij Kuchko, Director

Vasil Kutsenko, Dep. Dir.

Victor Svertoka, Head, Seed Growing Lab

Petro Overchuk, Head, Economics Lab

Nicoli Setchenko, Head, Production Technology

Crop Managers of State Farms

Vladimir Tuluh, Admin, Borodyanka District

Poleskaya Breeding Station, UIPR

Volodimir Vishnevskij, Dir.

Vasili Sidorchuk, Breeder

Ukraine Farmers Association

Oleg Kirnitski, Exec. Dir.

Kiev Base Storages, Leningrad Dist.

Oleg Tamzazov, Manager, Leningrad District

USAID, Kiev

James Osborne

APPENDIX IV

LITERATURE, SOFTWARE AND CHEMICAL REAGENT NEEDS

DR. ELENA BARINOVA, SPECIALIST IN PESTICIDES & ENVIRONMENTAL CONTAMINANTS, INSTITUTE OF BIOPHYSICS & BIOCHEMISTRY

List of literature for "Russian potatoes" (as submitted by Barinowa Helena)

1. Official Methods of Analysis (1990) 15th Ed. & to (1984) 14th Ed., & to its supplement, Association of Official Analytical Chemists.

2. Changes in Official Methods of Analysis.

3. Pesticide Analytical Manual, US Food and Drug Administration, Washington DC.

4. Manual of Analytical Methods of Pesticides in Human and Environmental Samples, US Environmental Protection Agency, Washington, DC.

5. Guide to Codex Recommendations Concerning Pesticide Residues, part 2: Maximum Limits for Pesticide Residues, Food and Agriculture Organization of the United Nation/World Health Organization, Rome, Italy

6. The Pesticide Manual, a World Compendium, Eighth Edition, 1987.

7. National Pesticide Survey, Columbus, OH, under from the US Environmental Protection Agency.

8. EPA Methods 501.3, 502.2, 503.1, 504, 505, 507, 508, 515, 524.2, 601, 602, 604, 606, 607, 608, 610, 611, 612, 613, 615, 619, 624, 625, 680, 1624, 1625, 8010, 8015, 8020, 8040, 8080, 8090, 8100, 8140, 8270, 8280, Federal Register.

9. Codex Committee on Pesticide Residues, Guide to Codex recommendations concerning pesticide residues. Codex Alimentaries Commission, FA/WHO, CAC/PR 6-1984.

10. R.O. Lidgard et al., Biomed.Environ.Mass.Spectrum.,13,677 (1986) and any literature about quantitating synthetic-pyrethroid compound.

11. Friedman,M. et al., Characterization of hydrolysis product of potato glycoalkaloids -chaconine and -solanine. Presented at the 204th National Meeting of the American Chemical society, Washington, DC, 1992; Abstract AGFD 88.

12 Glycoalkaloids and phenolics: GC, HPLC-analysis.
It is necessary for " Russian Potatoes" (for Barowina Elena).

List of FTS 7 Series Software Options for 3200 SPC-SES (Unix lang.)
For Russian Potato Concern

099-0983 Fourier Manipulations
Includes fact, cosine, transform, deconvolution, interpolation, Fourier derivative spectra and Fourier filtering- smoothing, low pass filtering, fringe removal.

099-0857 PCR-32, Principal Components Regression and Partial Least Squares analyses for quantitative analysis. Chemometric/Statistical approaches to quantitative analysis.

099-0775 Quant-32
Single-and multi-component quantitative analysis software for the FTS 40. Includes classical analyses, K-matrix, P-matrix and spectral fitting algorithms.

099-0850 AP-2, Applications Package Two Optical Programs-contains a program to compute the complex index of refraction from a reflectance spectrum; and a black body spectrum at any temperature.

099-0901 AP-5, Applications Package Five Programs for peak picking and baseline correction.

099-0902 AP-6, Applications Package Six Collection of programs used for spectral manipulation.

Standards and reagents that are needed for "Russian Potatoes" (for Barinowa Elena).

1. Silvlation reagents:
   BSTFA [N,O-bis(trimethylsilil)-trifluoroacetamide]
   88-299326-01

2. Acylating reagents:
   Fluorinated anhydrides.

3. Alkylating reagents:
   BF3-methanol
   88-301163-00

4. Pesticides Matrix Spiking Solution
   (in methanol)
   01-900009-02 (Analytical supplies catalog 1993-Varian)

APPENDIX V

PROGRAM PLANS OF THE RUSSIAN POTATO CONCERN (RPC)

Table of Contents

Complex Scientific - Technical Program "Potatoes and Potato Products"

Introduction

01. Program Objective:

Creation of a system of scientific-technical maintenance of the potato-growing branch with the aim of enlarging marketable potatoes and potato products resources; which includes yield raising, quality improvement, potato storage and processing wastes reducing.

02. Program Philosophy:

Singling out of the components necessary to develop the Russian potato complex under the commercial marketplace conditions: first stage - introduction of new technologies and component modernization; second stage - development of these and other components with a view to create an effective free enterprise in the potato complex.

03. Program Financing:

- All national basic and applied research is financed from the state budget.
- Equipment of the potato-seed certification centers and procurement of potato seed for reproduction in quantity (potatoes for industrial processing) is financed from foreign credits.
- Research on primary seed-growing, seed-growing technologies, storage and processing technologies, creation and production of biological protective means, microclimate creation means are financed by "Rossyisky kartofel" (Russian Potatoes Concern).

04. Branch Development Conception

Reproduction of marketable potatoes by producing certified potato seeds and reducing wastes owing to the expansion of storage base and processing at the place of production.

	Names of Targets and Main Stages	Date of Execution (Years)	Scientific/Technical Products
	Project 2 Selection		
2.1	Creation of highly productive types of potatoes with complex disease and pest tolerance, available for industrial processing and ecologically protective technologies of potato growing on the basis of using conventional (hybridization, experimental mutagenesis, polyploidy, etc.) and modern (cell and genetic engineering) selection techniques.	1992-1995	New potato sorts tolerant to diseases, pests and unfavorable environmental factors, available for processing and long-term storage will enable obtaining of highly productive, ecologically protective products and 25-30 percent reduction and harvesting and storage wastes. New potato sorts with preset parameters for different ecological zones, available for processing.
2.1.1	Putting to the state sort-test of high yielding potato sorts tolerant to prevalent diseases with a high content of dry matter (22-24 percent), available for processing, long-term storage and industrial technology of growing; reproduction in quantity;	1992-1995	New potato types with preset parameters for different ecological zones, available for industrial processing, storage and industrial technology of growing has been put to the state sort test.
	• a mid-ripe potato sort with preset parameters for the Non-Chernozem zone, available for food stuffs and industrial processing;	1992	

• a mid-early - mid-ripe type for the Non-Chernozem zone and povolzhye, available for food stuffs and industrial processing;	1993
• A mid-ripe - mid-late type for the Non-Chernozem zone, available for processing into ready made and half finished products;	1994
• A mid-ripe - mid-late type for the Non-Chernozem zone and povolzhye containing 18 to 20 percent of starch, available for processing into starch and other products.	1994
• A mid-late general purpose sort for the Non-Chernozem zone and Povlzhye available for food stuffs and industrial processing, among other things into ready made and half finished products;	1995
• A mid-ripe - mid-late general purpose sort for the Non-Chernozem zone available for food stuffs and industrial processing;	1995
• A mid-early sort yielding 350 - 400 centers per ha, containing 17 - 23 percent of dry matter, tolerant to canker, phytofluoros and available for mechanized harvesting;	1995

	• Highly productive types (five) yielding 420-450 centers per ha, tolerant to most prevalent diseases containing 22-24 percent of dry matter.	1995	
	• A middle early - middle-ripe type with preset parameters, available for food-stuffs and industrial processing;	1995	
	• a type yielding 30-35 tons per ha, tolerant to diseases, highly storageable, available for mechanized growing;	1995	
	• A mid-early type for the south of the Russian Federation, available for food stuffs and industrial processing;	1993	
2.2	Creation of new initial potato forms and sorts on the basis of the selection process integral technology (using cell and genetic engineering techniques).	1992-1995	The selection process integral technology will make it possible to correct the sorts on specific characteristics and to reduce the sort grading team up to five to six years.
2.3	Creation by a genetic engineering technique of plant forms to Cerant to "Y" and "L" viruses and carrying out of selection studies in agroecological zones with a high degree of the infectious load.	1992-1995	Transgenetic plants tolerant to virus infections in agroecological zones with a high degree of the infectious load.

2.4	Estimates and selecting the initial forms and the best foreign potato types with a high percentage of amidopectin (more than 90 percent) available for industrial processing.	1992-1995	Sorts with a high percentage of amidopectin.
2.5	Reproduction in quantity of the best national and foreign type populations in a generative way and their adaptation to different climatic conditions, ecological and infectious loads.	1992-1995	Introduction into practice.
2.6	Creation of new initial forms and potato sorts with a high percentage of protein using cell and genetic engineering techniques.		Sorts with a high percentage of protein.
	Project 3 Seed Growing and Certification		
3.1	Development and introduction of a virusless potato seed growing system by using highly effective sort-sanitation and reproduction techniques, modern pathogen diagnostics techniques, biopreparations with immunoregulatory effects.	1992-1995	Yields increase by 40 to 50 percent. Annual production of 10 million sanitized initial tubers and 140,000 tons of elite potatoes. New techniques of potato sanitation and clonal microreproduction in quantity using virus inhibitor and substances inducing plant tolerance of pathogens. New means of diagnosing virus and bacteritic diseases. New techniques of protecting sanitized seed potatoes on the basis of tolerance-inducing substances.
3.2	Development of the scientific methodical organization foundation for a system ensuring quality and	1992-1995	A system ensuring certification of potato seeds. New techniques of virus and bacteristic immune diagnostics. Techniques for estimation of potato seeds infection by highly aggressive strains of pathogenic organisms resistant to modern fungicides.

certification of basis and reproduction seed potatoes.

Sort identification and technique to control sort characteristics.

Foundation and maintenance of regional collections of the best meristem lines of sanitized potato sorts.

Express techniques of picking out sorts for regions with different climatic conditions, ecological and infectious loads. Techniques to estimate seed qualities and to predict micro and mini-potato tubers productivity in the process of elite seed growing.

Project 4
Growing Technology

4.1 Development of regional resource saving techniques of growing seed and food potatoes with due regard of agroclimatic conditions, ecological and infectious loads for:

- The Non-Chernozem Zone.
- The Southern regions of the Russian Federation.
- The Vral regions.

Yield increase and improvement of the tuber quality. Power consumption reduction by five to seven percent. Obtaining of ecologically protective production. Main tenency of the agrocenosis at the place of potato production. Initial requirements on developing machines and working bodies.

Regional recommendations and standard technological charts on seed, food and technical potato growing.

Setting up of a regional consultative centers system on applying optimal technologies including agrotechniques and agrochemistry.

A computer-assisted system for taking optimal decisions on protecting potatoes from diseases and pests during vegetation and storage (a computer dialogue system making it possible to take correct decisions accounting peculiarities of every field).

Project 5

Potato Production System

5.1	Finding out and analysis of potato diseases forms and bioinjuries spreading in different regions of the Russian Federation.	1992-1995	A catalogue of new potato diseases and bioinjuries forms, causes of their origin and spreading in different regions of the Russian Federation.
5.1.1.	Development of potato diseases and bioinjuries forms diagnostics techniques.		Methods of diagnosing latent potato diseases and bioinjuiries forms.
5.2	Development of an ecologically secure system of complex potato protection from diseases and pests on the basis of chemical and biological means and agrotechniques for different regions of the Russian Federation.	1992-1995	Regional systems of compic potato protection from diseases and pests.
5.3	Development of effective ecologically secure techniques of potato biological protection.	1992-1995	Decrease of the anthropogenic load on the agrocenosis. Increase of potato productivity and storagability.
5.3.1	Development of the scientific foundation for picking out protection means depending on the agrocenosis state and production purpose.		A principle of picking out potentially active biological protection means. An algorithm of picking out sorts and maintenance programs.
5.3.2	Study of biological protection means effectively, development of technologies to produce and apply means against the Colorado potato beetle, phytofluoros, etc.		A technology of producing and applying potato biological protection means. Data on the conditions under which phytopathogens become resistent to biological protective means and suggestions on the antiresistant strategy.

5.3.3	Obtaining of complex effect biocides of a vegetable origin.		Technical Documents. Operation Instruction.
5.3.4	Development of biological means for recultivation of phytopathogens infected soils.		Technical Documents. Operation Instruction.
5.3.5	Designing of a computer imitator of healthy and sick potatoes development.		Methods of reproducing scenarios of healthy and diseased potatoes development under different meteorological, phytosanitary and technological conditions.
5.3.6	Development of a technique of acroprobing the phytosanitary state of potato planting areas.		Harvesting wastes prediction techniques.

Project 6
Storage

6.1	Development of ecologically secure and effective storage techniques.	1992-1995	Storage technology providing for production protection measures against the anthropogenic load and reduction of storage costs.
6.1.1	Study of the effect of physical influences (aeroins) on reducing the content of deleterious substances in the process of potato storage (aldefydes, . . .?		Technical storage means.
6.1.2	Study of the transformation kinetics of biologically active substances in the process of storage with the aim of creating dynamic microclimate depending on the sort, physiological state and purpose (micro-mini tubers,		Dynamic modes of storing potatoes for different purposes.

	seed and food potatoes, potatoes for industrial processing).		
6.1.3.	Development of storage technologies using different combinations of physical, chemical and biological means depending on the potato sort, initial physiological state and purpose.		Prolongation of storage teams. Reduction of storage costs. Technical storage means.
6.2	Development of technical storage means.	1992-1995	Initial requirements on designing the equipment accumulating cold at nighttime to reduce power consumption and times; a prototype ventilation equipment with air cleaning from phytopathogenic microorganisms to prevent spreading of microbiological diseases in the storage process; equipment for automatic temperature, humidity and air aeration composition control.
6.3	Designing of store-houses of different capacity for regions with different ecological situations (on a competitive basis).	1992-1995	Standard designs of modern automatized store-houses of different capacity on the basis of using modern storage technologies, technological equipment, building and decoration materials with adhesive properties (reduction of micro-organisms adhesion to materials and increase of their biostatic properties).
6.4	Diagnostics and prediction.	1992-1995	Preservation prediction by nondestructive control techniques.
6.4.1	Development of techniques to predict potato preservation in the process of vegetation before storing potatoes for long-term storage and in the process of storage.		Prediction techniques.
6.4.2	Development of techniques for express-diagnosing production quality.		Estimation of tubers quality by the temperature gradient estimation techniques.

Project 7
Processing

7.1	Development of wasteless techniques of obtaining new potato products.	1992-1995	Wasteless techniques of obtaining modern potato products. Wastes utilization to obtain new forage kinds directly at the places of production and storage.
7.2	Development of techniques to process non-standard potatoes and potatoes with a high content of heavy metals, pesticides, radionuclides.	1992-1995	Technology of processing nonstandard potatoes. Ways of detoxifying potatoes with a high content of toxicants.
7.3	Designing of technological low and middle-powered lines for potato processing. Development of techniques to obtain from potatoes new kinds of raw materials for confectionery industry (ticacle, maltine, maltodextrine, glucose/fructose syrups).		Standard designs of modern technological lines of different productiveness to obtain: • peeled, preserved potatoes • dehydrated products (flakes, granules) • frozen products (french-freeze) • molted products from dehydrated raw materials • starch

Project 8
Ecology

8.1	Study of the ecological situation in seed growing farm zones. Recommendations on placement of farms.	1992-1995	Methodology of estimating toxicant quantity in potatoes (heavy metals, chlorine-phosphorus bearing pesticides by the distribution ratio of toxicant biosphere-plant" Charts of field contamination with heavy metals, pesticides, radionuclides, xenobiotics with the aim of determining ecologically secure zones for potato seed production.

			The farm ecoloproductive certificate ensuring conversion of farms to a free enterprise system: • Farm development perspective • Activity planning • Organization and production processes management with due regard for the ecological certificate
8.2	Development of methods to predict production quality depending on the ecological situation.	1992-1995	Accounting of the ecological factor influence on potato quality, yields, preservation by determining the content of nitrates, heavy metals and pesticides in the biosphere and study of the main biochemical recesses while growing and storing potatoes. Determination of synergism and antagonism effects in the time of toxicant joint operation. The integral index of production contamination based on the biogeochemical legend of the region and farm specialization. Methodology of predicting and planning agrochemical measures depending on the ecological situation.
8.3	Working out of recommendations on decreasing the negative ecological influence on the yield amount and quality.		Recommendations on decreasing production toxicity in the process of production and recommendations on storage modes during long-term storage. Recommendations on applying protection and the fertilizers system.
8.4	Working out of sectoral planning principles of the potato seed growing branch under private sector conditions with due regard for the ecology.		A system of marketable potato reproduction in the Russian Federation under the free economy conditions.

MEANS OF ACHIEVING THE PROGRAM OBJECTIVE

Project 1: The Russia Potato Complex Marketing

The complex scientific-technical program "The Potato and Potato Products" is the result of marketing studies of the state of potato growing. Besides, it suggests a system of measures to stabilize and develop the branch.

1.1 The State of Affairs in the Russia Potato Complex

Traditionally, the potato in Russia is one of the important agricultural crops. The potato is the main food product, source of vitamin C in winter, raw material for starch, alcohol and potato products. It is the only extensive export article in the countries of the Commonwealth and Independent States (CIS).

1.1.1 Potato Production

Potato production in Russia totals 33 million tons per year, 66 percent of the amount are grown by individual producers at their personal plots and holdings.

For at least ten years, the following negative trends have been clearly traced in potato growing:

- Recession of the potato gross output from 50 million tons in 1970 - 1980 down to 33 million tons in 1991;
- low yields, the average yield is 100 centers per ha, which differs slightly from the average yield of 1930 (90 centers/ha), but is much inferior to the potato yields in economically developed countries (350 - 400 centers/ha);
- deterioration of potato quality and storability.

Storage wastes in the state sector of economy averaged 20 percent in 1991 against 12 percent in 1990.

The measures taken in 1970 - 1980 were aimed at improving the state of affairs in the Russia potato complex:

- Increase of the potato gross output owing to the expansion of planting areas. This step turned out to be low-effective and led to the recession of potato yields and quality as it was not accompanied by adequate strengthening of the material and technical base of the branch;
- increase of the elite seeds production. It did not result in the marketable potato yield increase since no system to certify the seed material at different production stages had been created;
- construction of 17 powerful plants to produce potato food stuffs (granular, frozen potatoes).

The plants are still being built, their designs become obsolete from the technical point of view, their "market necessity" in most cases has not been verified.

For the last two years, the potato production structure has been changing in Russia. So since 1990-91, the potato share in the state sector has reduced from 46 percent to 34 percent, though the total volume of output was kept at the level of 33 million tons. Potato production has been increased at small plots (kitchen gardens, personal subsidiary plots, plots of land attached to houses, etc.) but absence of modern protection means and the certified seed material will not make it possible to obtain high yield of the high quality potato.

Thus, potato production in Russia is characterized as in developed countries.

The structure of the potato usage in Russia and the U.S. is given in Table 1.

Table 1

Structure of the Potato Usage in Russia and the U.S.

The Potato Index	The Potato Usage (Percent)	
	The Russian Federation (1985 - 1990)	The U.S. (1985 - 1987)*
1. Food potato: • fresh • processed	33 32.2 0.8	32 31 51
2. Technical potato: • processed into starch and alcohol	4	1
3. Seed potato	2.9	7
4. Forage potato	14	2
5. Storage wastes	20	8

* Forotkykk, A.A., Sotnikor S.V. Potato Growing in the U.S.A: State-of-the-Art and Peculiarities of Development (Scientific paper), Moscow, 1987.

1.1.2 The Potato Consumers' Market

At present, the Russian market is oriented exclusively to consuming fresh potatoes (98 percent), because of substantial storage wastes some Russian regions have depleted potatoes by spring.

For this connection, there arise two questions:

1. What is the desired volume of the potato output?
2. What is the structure of the marketable potato usage?

The volume of the marketable potato output is defined by the necessity of consumption for:

- food purposes
- technical products (starch, alcohol)
- seeds

The need of potatoes in Russia totals 0,105 ton/head x 1,5 x 10^8 people = 15,5 million tons. Most probably the average annual demand will not change before the year 2000 because this level is the maximum consumption in the world (Great Britain and Ireland's, lower consumption happened because of a considerable increase in fruit and vegetable consumption all year round, which is not likely to take place in the coming eight years in Russia.

The structure of fresh potatoes as food will most likely change by the year 2000 owing to an increase in consumption of processed potatoes (from 0.3 million tons in 1991 to 2 million tons in 2000).

Potato production for technical purposes will increase as a result of:

- changing the imported maize for the potato;
- increasing demand for starch and alcohol in the external and home markets.

The demand for the technical potato is estimated at 25 to 30 million tons. Processing of the potato is restrained by limited production capacities of starch-treacle and alcohol plants (obsolete equipment and lack of purification installations).

Potato production to obtain starch is highly profitable as it decreases farmers' and farming establishments' storage costs and is in persistent external demand. During the period from 1976 to 1986 potato production for starch grew in the Federal Republic of Germany from 0,3 up to 1,4 million tons (from 2.1 percent up to 21 - 25 percent of the potato gross output).

Usage of the potato for seeds is one of the problems in the Russian Federation potato complex. By the year 2000 the volume of seed potato output is likely to recede up to 7-6 million tons owing to the improvement of the seed productivity and increase of the elite seeds output (0,25 million tons).

According to different information sources, the volume of the non-marketable potato used for forage is from 12 percent to 23 percent of the gross output, such as uncertainty is explained by including into this index some part of wastes. Potato usage for forage purposes is not profitable from the economical point of view. In highly developed and developing countries it makes up to 2-3 percent of the gross output. That is why by the year 2000 potato usage for forage purposes will have reduced up to 10 percent and will total not more than 3.5 million tons.

Harvesting, storage, and realization wastes are high, they averaged 50 percent in the period from 1985 to 1989.

Waste levels in 1929-1930 and wastes predictions for 1999 - 2000 are given in Table 2.

Table 2

Harvesting, Storage and Realization Wastes in Russia in Different Periods of Time

Period	Wastes (Percent)			Information Source
	Harvesting	Storage	Preparation and Consumption	
1929 - 1930	3	12	5	Agricultural encyclopedia, 1934
1985 - 1989	6 (combine) 12 (diggers)	20	20	Scientific-technical program "Potato storage Rosslkhoz-akademia, 1991
1999 - 2000	3	10	10	Projection

Increase of potato wastes in the 1980s compared to 1929 - 1930 is caused by tubers traumatization in the process of machine harvesting and by building the storage base in towns and cities (additional mechanical and microbiological injuries, aggravation of the ecological situation in the central Russian regions).

There is every reason to expect a reduction of potato losses by 2000 at the expense of:

- Using the new generation combines, which traumatize tubers to a smaller degree;
- Moving the storage base to the places of production with better ecological conditions;
- Using more productive and storable potatoes.

1.2. Marketing is the Basis of the Potato Complex Organization and Management

Up to now, there has not been any projects in the field of marketing. Marketing as a theory and an approach to solving problems makes it possible to develop in Russia a new form of organization and management of potato production in the potato complex with the aim of realizing the reforms that are being conducted by the government.

Analysis of the available literature on marketing and its evolution in capitalist countries shows that this is the most effective means of achieving the market aims and obtaining a profit. Such a type of marketing is called commercial marketing. Noncommercial marketing appeared in the West in the 1980s. It is being realized by organizations and persons acting in social interests, i.e.. their activity does not bring them any profit. The main thing is commercial and noncommercial marketing is the approach to solving problems. For our country, marketing in potato production may become a new form of production organization

and management, the accent is made on the innovation processes which are formed on the reasonable ratio of the "free" economic activity and the state planned policy.

In this connection, great responsibility for the innovation processes lies on the new organization structures that are to pursue a policy of adapting science capacious and resource solving technologies. Under the term "technology" we imply practical activities not only in the sphere of obtaining new products and production technologies but also bridging up the technological gap compared to the equivalent branches of the economically developed 10 -15 years, in some particular lines up to 20 years by means of structural transformations in the branch, and also thanks to the personnel policy, juridical and financial support, etc.

Science integration into production supported by the state bodies will make it possible to neutralize the negative tendencies which might arise or already have taken place in the course of the market formation (price increase, deterioration of quality, cutting down of planting areas). It may be obtained first of all by setting up organizations the infrastructure of which meets the market practice and, at the same time, is directed at developing the national potato market and adaptation of science capacious technologies.

Such organizational structures are supposed to unite the scientific organizations and producers for the sake of concentrating the scientific technical potential and financial resources and creating a system serving the potato growing branch.

The system of interrelations and coordinated activities of state bodies and such organizations will allow to predict the branch state, plan and carry out projects, exercise control of the innovation processes aimed at potato reproduction and profit formation by producers.

1.3 Priority Scientific Technical Guidelines in the Russia Potato Complex

Analysis of the Russia potato complex state (first and foremost consumer market demands) and of the tendencies typical to the economically developed countries (the United Nations proceedings, Food and Agricultural Commission, 1991) shows that the priority scientific technical guidelines by the year 2000 are supposed to be as follows:

- Growing of new potato sorts tolerant to a complex of diseases, different climatic and ecological conditions, with good gustatory qualities; creation of a system of certifying the virusless and reproductive seed material;

- increase of yields and quality of marketable potatoes owing to growing potatoes in the fields that meet the national and international quality standards; usage of the ecologically secure potato complex protection system; applying of the cultivation and harvesting techniques that do not cause substantial injuries, updating of processing, storage and marketing processes;

- working out of modern technologies for obtaining food, potato products assortment (peeled, preserved, dehydrated, frozen and molted potato products) and products for different industrial branches (with the content of amylopectin about 90 percent);

- reduction of labor and power consumption within the framework of the potato production process as a result of updating agricultural machines, equipment, technological processes, management and usage of computers to calculate costs;

- integration of "Rossyisky kartofel" concern into the program, as a developer and executor, with the aim of quick introduction of R&D results, correction of the program in accordance with the market demands, involvement of out-of-the budget means for its realization.

Project 2: Selection

Now there are 95 region-adapted potato varieties in the Russian Federation. "Nevsky", "Lugovskoy, "Rezerv", and "Lasunak" are the most widely distributed modern potato varieties.

A number of new varieties grown in the Russian Federation selection centers has been region adapted for the last few years (1989 - 1992). Among others are "Bronnitsky" (middle-ripe, high yielding, available for industrial processing), "Izora" (early-ripe, high yielding), "Lukyanovsky", Bzyansky (early-ripe, with a good gustatory taste).

The potential productivity of the new varieties, according to the results of the selection and state tests, averages 40-60 tons per ha, though under production conditions they yield of many varieties is only 25 to 30 percent of their potential productivity. Many varieties do not possess complex tolerance to diseases and pests. There are but only very few varieties tolerant to ecological loads.

Potato-growing farms experience lack of early-ripe potato varieties, especially in the Povolzhye zone the Central Cheznozen regions, in the south of Russia, these regions also need varieties tolerant to heat, drought and virus diseases. The Non-Chernozem zone needs mainly varieties tolerant to phytofluozos, rhizoctonia, with good gustatory qualities, storable, available for industrial cultivation and processing technologies.

In this connection the problem of creating new potato varieties that might satisfy agricultural production needs taking into account various soil-climatic conditions and products usage purposes remains to be one of the most important problems of the branch scientific technical maintenance.

It is planned to carry out potato selection according to the following guidelines.

- Growing of early-ripe varieties tolerant to virus and other diseases, available for mechanized cultivation, growing of tubers different in forms and coloration;

- growing of varieties available for industrial potato processing into half-finished and prepared potato products with a small content of reducing sugars in tubers (0,1 - 0,3 percent) and the stable 25 percent content of dry matter, with a long rest period, storable, tolerant to prevalent diseases.

- Growing of potato varieties with a large content of starch available for industrial processing into starch and starch products, middle-ripe and middle-late ripe, with the content of starch about 20 - 25 percent; and dry matter 25 - 30 percent.

The selection work envisages selection on yielding (40 - 50 tons/ha under optimal conditions), tolerance to diseases and pests (canker, phytofluoros, viruses, bacteriosis, rhizoctoniosis, golden nematode), which significance varies for different regions tolerance to unfavorable and stress environment factors and availability for industrial cultivation technologies.

Project 3: Seed Growing and Certification

Potato seed growing comprises two main blocks: elite and reproductive.

The elite block includes prime seed growing laboratories, super establishments and elite establishments.

The reproductive block includes seed-growing establishments and seed growing plots in potato growing establishments.

In 1991, in the Russian Federation it was grown 130,000 tons of elite seeds and 2 million tons of potato seeds of the 2nd reproduction, which is insufficient both for the state and the private sectors. The net reproduction at different stages of seed-growing was approximately 1:4, which is inferior to that of the main countries producing the seed potato (the U.S. Germany, Netherlands, Great Britain) where the net reproduction is 1:6. Such a situation in the Russian Federation is explained mainly by the low quality of the elite and reproductive material caused by the absence of biochemical and immunological control at different stages of production, which leads to reproduction in quantity of the low-productive material (20 - 25 percent).

This, in its turn, results in losses of:

- Time (one year per each elite production cycle);
- areas (the specific cost of which is two to four times higher than that of the marketable plantations);
- labor and material costs in the elite block.

Thus, the first important component of seed growing development is creation of a system of effective biochemical and immunological control at all the stages of seed-growing and phyto-certification of the elite and first and second reproduction seed material which is put on the market. This might result in:

- Increasing the net reproduction up to 1:5, which will fully satisfy the needs of the Russian Federation potato complex in the seed material without expanding the areas under seed-potato cultivation;

- cutting down labor and material costs of the seed material production, which will reduce the relative price of the seed potato;

The work on creating the scientific/methodology and organizational foundation of a system providing the quality and certification of the basis and reproductive seed-potato is planned in the following directions:

- Development and organization of production of modern means to diagnose virus, bacterial, fungoid diseases with the aim of maintaining local laboratories;

- provision of mass diagnostics to control samples of the initial material, the elite and the super-elite against viruses and bacteria by immunoferment analysis technique (tuber material, postharvest control, leaf samples at the stage of vegetation);

- provision of control and certification in the main potato producing zones of the Russian Federation, taking stock of virus carriers and notifying of seed growing establishments of the mass summer terms;

- improvement of the soil control technique with the aim of using the results in the seed potato certification system;

- provision of sanitized seed potato growing technology accounting protection against the recurrent catching of virus diseases and phyto-fluoros to shorten the period of the seed potato ripening owing to applying biologically active substances with the immunoregulatory effect;

- working out of normative and technical documents on the seed-potato control and certification;

- sanitization of potato varieties and provision of seed growing establishments with sanitized initial material;

- development of genetic control of meristem lines and of varietal identification by defining protein and isoferment spectra by means of electrophoresis in polyacrylamid gel.

Project 4: Growing Technology

At present in the Russian Federation, several technologies and their modifications are applied. They differ in the space between rows, planting schemes 70 cm, 60-80 cm, 90 cm, 110 - 30 cm, 140 cm, etc, adaptation to different soil types (sandy, loamy, stony, peat-bogs, etc. purposes (for seed, for food potato). They are based on the usage of scientific workings out of the regional scientific institutions and achievements of the world practice, first and foremost of Western Europe (Netherlands, Germany).

Thanks to their application in a number of farming establishments, it has become possible to considerably increase yields to decrease labor costs and power consumption, and to increase the level of mechanization. But in general, these branch factors are still inferior to those of potato-producing countries (the U.S., Netherlands, Germany, etc.) It may be

explained by the fact that the attempt to transfer some techniques, successful for definite soil-climatic conditions, into different conditions is not always successful. Besides, there is no machinery that allows to carry out the kinds of agricultural work that are necessary in conformity with farming conditions, the technological discipline.

At the same time, the applied standard technologies do not take into account, to a sufficient degree, the variants of this or that technique which can depend on a particular situation. The problems of guaranteed application of combines for potato harvesting have not been solved for all the soil and climatic conditions, which leads to higher labor costs and wastes.

It is necessary to develop techniques of applying fertilizers and plant protection means which will provide for ecologically clear production containing no pesticides, nitrates and heavy metals.

The project envisages development of resource saving, ecologically secure technologies for different soil climate conditions, new technological means to obtain high quality production, to maintain and increase the fertility of soil, and to protect the environment. The technologies are supposed to be aimed at saving metals, power, labor, and cutting down of usage of chemical means, and protecting plants against diseases, pests and weeds.

It is suggested that studies of intensive, wide row and bed technologies and their modifications should be carried out conformably to light, heavy and super wet soils with a different degree of herbicides use and protective means against diseases and pests, to combine the most economical variants of tilling soils, looking after plants and harvesting. It is also necessary to set up new working bodies and to design new machines and equipment.

In the framework of the program, the scientific institutions are planned to establish proving grounds in the Bzynsk, Leningrad, Moscow, Tula and Samara regions in southern Russia, Siberia, and in the Far East to master and verify potato cultivation technologies.

Mathematic models and consultative computer systems will also be developed to take optimal decisions on applying agrotechniques and protective measures depending on the specific weather conditions, the state of plants and the soil complex, the level of agrotechnology, availability of technical means and peculiarities of biocenosis and the ecological situation.

Project 5: Potato Protection System

For the last several years, potato growing in the Russian Federation has been developing under a strong influence of the Dutch potato growing system providing for a considerable usage of chemical protective means strictly regulated in dosage and time (during the vegetation period it is necessary to carry out six to ten tillages by contact chemical protective means).

In this case, yields depend on the accuracy of fulfilling all the technological measures which is rather difficult in Russia because of vast cultivation areas in the marketable farming establishments and the lack of machinery.

On the basis of analyzing the results obtained in different regions of the Russian Federation where chemical protective means are used and the foreign scientific publications, one might make the following conclusions:

1. Chemical protective means are toxic substances dangerous not only for the villagers who come in contact with them, but also for those who live in the area of their application.

   The imported plant protection means are intended for usage in the warm climate of America and Europe. In the central and northern regions of Russia, these means do not destruct completely because of lack of thermal energy (photodestruction) and that is why they are accumulated in the atmosphere (aerosols), soil and reservoirs. That was just the cause of the population toxicological poisoning at harvesting on the farms of the Sverdlovsk region in 1989-1991.

   In Sweden and in Finland, increase of oncological diseases is connected with the intensive application of chemical protective means while cultivating potatoes. The U.S. which takes the fifth place in the world in chemical protective means production for the last five years has considerably decreased the patent activity in their development and cut down their application at potato plantations (according to the U.S. and Canada Institute of the Russian Academy of Sciences American farmers use fungicides, herbicides and insecticides at 75 percent of their areas and plant to cut down considerably their application by the year 2000).

2. Application of chemical protective means in highly developed countries and in the Russian Federation has led to the natural selection of the most resistant and aggressive strains of microorganisms and other pests (pests adaptation to pesticides), which makes it necessary to change standard protective means into new more effective and more toxic ones (for the last 30 years, 20 preparations against the Potato Colorado Beetle have been changed).

   Such a situation serves to reduce the development of biological protective means, ecologically secure, adaptable to changing ecological conditions in some particular regions.

   At the Russian Scientific Centers (NPD "Bio-technologia", NPO "Biomash," Institute of Phytopathology, etc.) original microbiological, protective means have been developed. Some part of them is produced at the pilot installations and is tested in the fields, including the establishments of "Rossyisky kartofel" Concern. The Concern plans in 1992-1995 to work out the scientific basis for developing complex effective microbiological means and together with other organizations to introduce them on a large scale into practice of potato-growing establishments to replace the imported chemical protective means and to improve the ecological situation at these establishments.

Project 6: Storage

Storage is the most important factor on the path of the potato from the field to users.

About 9000 tons of seed potato and about 15 million tons of table and technical potatoes are put to storage, i.e., up to 70 percent of the gathered crop. The potato is stored in:

- Specialized storehouses at fruit and vegetable bases in cities and towns, on the state and collective farms in the units of the Russian Federation Defense Ministry and of other ministries;
- piles, basements and cellars in the country;
- Ill-adapted premises, as a rule in towns and settlements.

The volume of the potato stored in 1991 in storages of different types is given in Table 4.

Table 4

Volumes of Potato Storage in Storehouses of Different Types

The Potato	Storehouse Type, Millions of Tons		
	Specialized	Piles	Cellars and Basements
Seed	2,1	0,9	6,0
Table	4,5	0,8	9,2
Technical	0,1	0,2	---

Storage wastes may differ in volume. It depends on the potato variety and storage conditions. The least wastes are registered when the potato is stored in specialized storehouses (up to 8 percent). The greatest are found when table potatoes are stored in piles at the fruit and vegetable bases and in well adapted premises. Average statistical storage wastes in 1985 to 1989 in the Russian Federation were about 20 percent.

The analysis of the results of potato storage in specialized storage facilities of different types in towns (fruits and vegetable bases) and in the country shows that there are three groups of causes that influence the storability of the potatoes.

1. Construction defects of potato storages:
   - Unevenness of air exchange in the sections, bins and containers because of the incorrect location of air distributing channels. At the speed of air fluids of 0,5 mils transference of spores and infection of healthy tubers by

microscopic funguses take place at the speed of 0,1 m/s bacteritic diseases may arise;

- the usage of concrete as a construction material creates favorable conditions for the development of the pathogenic microflora in the concrete pores;
- absence of automatized systems of optimal humidity maintenance.

2. Quality of the potato that is put to storage:
   - poorly storagable varieties;
   - tubers with a higher content of nitrates, which is the cause of lowering immunity in the process of storage because of the intensification of breathing and recession of Vitamin C and phytoalexins content;
   - tubers with microbiological and mechanical injuries (a positive exponential dependence on the degree of injury is stated);
   - tubers of different sizes with different inner thermoregulation that need different temperatures for optimal storage.
3. Ecological conditions of storage:
   - Usage of external air for ventilating storehouses in d) polluted regions. The toxical substances (nitrogen oxides, sulphur, lenobiotics) that are in the external air are completely absorbed by the potato, which leads to accelerated destruction of vitamins, bioantioxidants and inhibition of phytoalexins formation;
   - presence in the storage zones of the higher technological (exhausted gases, ammonia) and microbiological backgrounds, especially for large-scale storehouses.

Statistic handling of data on wastes shows that the greatest influence on the potato storability exerted by such factors as putting to long-term storage of poorly storable varieties and injured tubers (30 percent), violation of the bioclimatic and agricultural growing conditions (20 percent), violation of the storage mode (30 percent), presence of higher microbiological and toxicological backgrounds (20 percent). (Proceedings of the Russian Academy of Agricultural Sciences, 1992, no. 1, p. 67).

On the basis of the above, the following conception of developing potato storage bases is suggested.

1. Reconstruction of storehouses of old types.

There are about 15000 storehouses of old types in the Russian Federation, 70 - 75 percent of them are to be reconstructed. It requires 2.5 to 3.5 times less investments than construction of new storehouses.

Reconstruction of storehouses will be carried out along the following lines:

- Increase of their capacity either at the expense of replacing the bin way of storage by the section and pile ones or increasing of the height of the layer of the potato to be stored (1.5 - 1.8 times).

- increase of the thermal assistance of the outward walls with the help of an air-thermal protection system and an additional thermoinsulation covering;

- usage of modern equipment for automatic creation of the desired microclimate.

Reconstruction of storehouses will last four to six months. Reconstruction is supposed to enlarge the capacity of specialized potato storehouses by 1.5 - 1.8 million tons.

2. Construction of storehouses of new types.

Potato storehouses have been projected by the only organization--"Giproniselprom". Lack of competitiveness resulted in a low efficiency of the storehouses built according to these projects.

In 1992, Rosselkhozacademy and NPO "Juhranenie (= "storage") announced a competition for the best potato storehouse project. Foreign firms are also invited to take part in this competition.

Project 7: Processing

Potato processing results in new food products which distinctive feature consists in the fact that the new products are no longer perishable, though it is necessary to constantly maintain definite storage conditions (temperature below zero for frozen products and relatively low air humidity for dried prepared products). Processing is directed at:

- creating products stocks of long-term storage;

- liquidation of potato storage wastes;

- rational usage of wastes at potato complex processing;

- broadening of potato products assortment with the aim of enriching the products with special additions and shortening of the period of preparation;

- diminishing of capacities for storage and transformation by seven to eight times compared to the fresh potato.

For the last several years, the task to decrease the content of toxicant during processing has been set.

Potato Processing in the Russian Federation

At present, the potato processing branch practically does not exist in the Russian Federation. It is in the making.

In the Russian Federation, the greater part of potato products is produced by the Moscow or Malgamation "Koloss" which is provided with imported equipment.

In 1991, cutlets, round rissoles, half-finished potatoes, chips in the form of leaves, crackers and flakes were produced. In 1992, the volume and assortment of production decreased because of lack of currency. Now quality is explained by using a mixture of varieties as raw materials.

In the 90s, construction of 18 enterprises for potato processing began in different regions. It is necessary to note that some enterprises are being built in regions where the potato is not in plentiful supply which might cause difficulties with the raw material in the future.

At present, the economically developed countries produce a large amount of processed potato products.

Consumption of the Processed Potato in Some Countries (1985 - 1990)

Country	Processed Potato Percentage of Gross Output	Processed Potatoes Consumption kg/capita/year
The Russian Federation	0,2	0,5
The U.S.	50	32
Germany (The FRG)	17	28
Great Britain	40	30
Denmark	28	28
The Netherlands	17	20

Among these countries, the U.S. is in first place. The way the potato-processing sector in the U.S. is being developed and the interrelations between the storage and processing sectors within the branch are of great interest to Russia.

Potato Processing in the U.S.

In the 20s, the U.S. just as the Russian Federation does today, consumed 100 kg/capita only of fresh potatoes.

Later on, when a great supply of vegetables and starchy foods (especially macaronis), used as garnish entered the American market, the potato consumption decreased. In 1950, it averaged 48,1 kg/capita (which is equal to the potato consumption in the southern regions of the Russian Federation).

In the 1980s, potato processing started to develop at a rapid pace in order to stimulate the potato market. Since 1950 and up to 1980, potato consumption per capita has grown in the U.S. from 48,1 to 54,6 kg/head.

Potato Consumption per capita in the U.S.
kg/head/year*

Year	Overall	Fresh Potatoes	Processed Potatoes**				
			Crisp	Frozen	Dehydrated	Pre-served	Total
1910	99						
1930	60						
1950	48,1						
1960	48,7	38,4	5,3	3,0	2,3	0,3	10,3
1970	53,3	26,4	8,0	12,6	5,4	0,9	26,9
1980	53,5	25,4	7,7	15,3	4,1	0,9	28,1
1984	54,6	23,5	8,3	17,2	4,5	0,8	31,8

* Data of the U.S. and Canada Institute of the Russian Academy of Sciences.
** Fresh potato weight.

American specialists believe that by the year 2000, the U.S. will process 70 to 80 percent of the potato gross output. Only high quality potato varieties will be consumed without processing.

The main factors causing the increase in processed potato consumption:

- gathering momentum of the tendency to take meals in restaurants and fast food outlets;
- a rise in fresh potato prices and at the same time a fall in processed potato prices;
- reduction of potato storage costs;
- increase of the women's share in the labor force in the U.S. One percent increase in the number of working women leads to 0,17 percent increase in the processed potato products consumption and 0,24 percent decrease of the fresh potato consumption.

The are 384 potato processing enterprises, most of them (222) produce chips. The processing enterprises are located at the places of production and, as a rule, have capacious storehouses (150,000 tons).

Conception of the Potato Processing Development in the Russian Federation

1. To finish the construction of facilities, to provide the equipment and to set working 18 enterprises producing a big variety of potato products for industrial centers, northern and far east regions to create the strategic resources in Russia (Table 3).

   With the aim of a regular supply of material technical resources, it is necessary to turn over the enterprises to holding companies ("Rossyisky kartofel" Concern for regional joint stock associations).

2. To design and serially produce sets of low-powered equipment in order to provide shops producing potato products or state farms collective farms and firms serving farmers.

   To envisage wasteless production using wastes (20 percent) to obtain starch and the wastes that are not available for further processing (up to six percent) as fodder.

3. To announce a competition for the best project of a potato processing shop on collective, state farms, and firms serving farmers.

4. To design and serially produce low-powered installations to produce fried potato products out of half-finished products with the aim of putting out products on the spot at public catering establishments.

5. To design and serially produce equipment creating the necessary microclimate in storehouses and machines for postharvest conditioning of the potato and vegetables which are to be put to long-term storage.

6. To set up a center on testing equipment and machinery for potato processing and storage. Work out recommendations on serial production. The tests will be carried out according to the programs that meet the international standards and their results are compared to those of modern imported equipment and machinery.

Project 8: Ecology

The analysis of the ecological situation in potato growing zones shows that 70 percent of the fields are in the regions of a higher ecological risk.

Some years before, Scientific Research Institute "Xhranenie" (Storage) has carried out preliminary investigation works on analyzing the sources of toxicant penetration into plants in the process of regulation and their transformation in the tubers in the process of storage.

The sources of toxicants are as follows:

1. Precipitation

   - Atmosphere aerosols that are formed in the process of fuel burning and as by-products at chemical plants (aerosols contain basically heavy materials and different xenobiotics);

- acid rains caused by joining nitrogen and sulfur oxides with moisture;;
- aerosols containing pesticides.

2. Reservoirs and Sewers of Industrial Enterprises

- Industrial enterprises, as a rule, do not have purifying installations and that is why sewers contain heavy metals, nitrogen oxides, xenobiotis which are transferred to the fields if sewage is used for watering.

3. Soil

- Fields in the vicinity of highways accumulate lead;
- fertilizers that are spread over the fields may contain considerable quantities of heavy metals. For example, phosphoric fertilizers contain cadmium. There are 15 - 100 mg. of cadmium per kg of super phosphate and 4 - 42 mg of cadmium per kg of potassium phosphate;
- nitrates and pesticides, their content is changed to some degree in time and, depending on the quality of precipitation, light and other environmental conditions;
- sediments in sewers used in some regions as fertilizers contain wastes of galvanic, metallurgical, chemical and mechanical productions.

There arise three groups of questions:

- In what way toxicant are absorbed from the biosphere?
- In what way toxicant are transmutated and how do they influence the main physiological and biochemical processes in potato tubers in the process of storage?
- Potato detoxication techniques.

Up to now, there do not exist solutions to the problems, which do not allow to estimate the influence of the ecological factor on the varietal genetic degradation on plant development in zones with different ecological situations and on potato storability.

The proposed project is aimed at solving the above mentioned problems.

3. Realization of the Program "The Potato and Potato Products"

The results of the scientific technical program "The potato and potato products" will be introduced into practice of the "Rossyisky bartofel" Concern enterprises (it invests part in

R&D) and other enterprises of the branch accounting their financial potentialities, technological level and personnel qualification.

The program realization schedule is given in Table 6. It envisages at the first stage (1992 - 1999) further development of these components, with the components of potato production and processing functioning either as a part of a single whole or independently.

Table 6

The Program Realization Schedule
(within the Framework of "Rossyisky kartofel" concern)

Work, Process	1992-1993 3	1994-1995 4
Seed potato production without expanding planting areas, with the net reproduction 1:6, thousands of tons:		
• elite	60	90 0
• first reproduction	250	450 0
• second reproduction	900	2000 0
Setting up of the certification centers, pieces; volume of the certified potato, thousands of tons:		
• elite	20	40 0
• first reproduction	80	160 0
• second reproduction	300	600 0
Reproduction of the imported sorts up to the second reproduction and potato production to obtain:, thousands of tons:		
• granules	15	40 0
• starch	10	30 0
The marketable potato production without expanding planting areas, with the net reproduction 1:5 and a higher storability, thousands of tons:		
• potato for food	4000	9000 0
• for potato products	70	200 0
• technical potato (starch, alcohol)	50	200 0
Production of biological protective means against:		
• phytofluoros	10	15
• the potato Colorado Beetle	5	10
• Others	20	25

Potato food stuff production, thousands of tons: • granules • chips • preserved potatoes • frozen	 10 4 2 -	 30 10 10 5	 60 20 20 10	 160 40 50 20
Creation of the storage base, thousands of tons: • Creation of the storage base, thousands of tons: • Reconstruction of storehouses of old types • Construction of storehouses of new types	 10 2	 80 30	 80 20	 80 20
The seed potato storage base, thousands of tons	8	40	40	40
The marketable potato storage base, thousands of tons	4	70	60	50
Potato products storage base, thousands of tons	--	5	10	10
Volume of packed tubers, thousands of tons		20	30	30
The potato export, thousands of tons: • seed potatoes • food potatoes • technical potatoes	 50 100 2	 100 200 5	 300 300 10	 300 300 10

Production of special machines of new types, pieces: • rotary cultivators • equipment sets for applying protective means • potato picking combines • equipment sets to sort potatoes • sets for packing tubers • potato loaders	 50 50 50 20 10 10	 100 100 100 20 200 30	 100 100 100 20 200 50	 100 100 100 20 200 50
Improving of personnel qualification, men	200	1000	1000	1000